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# **Adapting to the Impacts of Climate Change**

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# Overview

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- Charge to Virginia Commission on Climate Change
- Defining Adaptation
- Pew Center Brief—Climate Change 101: Adaptation
- Examples
  - Health
  - Wildlife
  - Land use
- VA and MD recommendations



# Charge to Virginia Climate Commission

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## Climate Change Action Plan:

1. Inventory the amount of and contributors to Virginia's greenhouse gas emissions, and projections through 2025
2. Evaluate expected impacts of climate change on Virginia's natural resources, the health of its citizens, and the economy, including the industries of agriculture, forestry, tourism, and insurance
- 3. Identify what Virginia needs to do to prepare for the likely consequences of climate change**
4. Identify the actions (beyond those identified in the Energy Plan) that need to be taken to achieve the 30% reduction goal and
5. Identify climate change approaches being pursued by other states, regions and the federal government.



# Adaptation Defined

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The International Panel on Climate Change defines adaptation:

“Adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts.”

The Pew Center on Global Climate Change defines adaptation:

“Actions by individuals or systems to avoid, withstand, or take advantage of current and projected climate changes and impacts. Adaptation decreases a system’s vulnerability, or increases its resilience to impacts.”



# The Need to Plan for Adaptation

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- Limits on emissions will not be enough, or happen soon enough, to avoid all impacts of climate change.
- Reducing emissions will decrease the magnitude of global warming and its related impacts. But carbon dioxide and other greenhouse gases can remain in the atmosphere for decades or centuries after they are produced.
- Adaptation efforts are necessary to reduce both the cost and severity of both mitigation and climate change impacts for decades to come.



# Pew Center Brief

## Climate Change 101: Adaptation

*Choose adaptation options based on a careful assessment of efficacy, risks and costs.*

- No-regret: Actions that make sense or are worthwhile regardless of additional or exacerbated impacts from climate change.
  - Example: protecting/restoring systems that are already vulnerable or of urgent concern for other reasons.
- Profit/opportunity: Actions that capitalize on observed or projected climatic changes.
  - Example: shifting to different crops that are better suited to changing climatic conditions.

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# Pew Center Brief

## Climate Change 101: Adaptation

*Choose adaptation options based on a careful assessment of efficacy, risks and costs.*

- “Win-win:” Actions that provide adaptation benefits while meeting other social, environmental, or economic objectives, including climate change mitigation.
  - Example: improving the cooling capacity of buildings through improved shading or other low-energy cooling solutions.
- Low-regret: Measures with relatively low costs for which benefits under climate change scenarios are high.
  - Example: incorporating climate change into forestry, water, and other public land management practices and policies, or long-term capital investment planning.

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# Pew Center Brief

## Climate Change 101: Adaptation

*Choose adaptation options based on a careful assessment of efficacy, risks and costs.*

- Avoiding unsustainable investments: Policies or other measures that prevent new investment in areas already at high risk from current climatic events, where climate change is projected to exacerbate the impacts.
  - Example: prohibiting new development in flood-prone areas where sea-level rise is increasing and protective measures are not cost effective.
- Averting catastrophic risk: Policies or measures intended to avert potential or eventual catastrophic events—i.e., events so severe or intolerable that they require action in advance based on available risk assessment information.
  - Example: relocating Alaskan villages in areas at or near sea-level with projected sea-level rise and increasing severe weather events.

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# Pew Center Brief

## Climate Change 101: Adaptation

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- Adaptation measures at the local level:
  - Local actions include:
    - desalinating freshwater sources;
    - protecting infrastructure and communities from flooding, erosion and more severe weather events;
    - and preparing for more severe water shortages and droughts.
  - These initiatives and others may be privately funded or managed, or they may be the responsibility of municipal, emergency response or other agencies.



# Example: Human Health

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Impacts may include:

- Severe weather events, floods, heat waves
  - injuries, illnesses, deaths
- Changes in vector-borne illness, zoonotic diseases and exposures to toxic substances
- Waterborne and airborne diseases and/or allergic or respiratory illnesses or conditions; threats to food and water supplies
- Harmful algal blooms (HABs)
- Mass migration/evacuation



# Example: Human Health

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- Public Health Preparedness
  - Occurs in the face of scientific uncertainty
    - influenza pandemic
    - terrorist attack
    - hurricane
- Risk Management
  - Systematic ongoing efforts to identify and reduce risks to health



# Example: Human Health

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- **VDH Emergency Preparedness and Response Program (EP&R)**
  - Preparedness and response to all emergencies
    - Availability to respond 24/7
  - Rapid response to outbreaks
  - Build public health infrastructure
    - Increase/enhance local capacity - planners and epidemiologists in all 35 health districts
    - Establish regional response teams
  - Potential to address:
    - Extreme weather events, heat waves/stress
      - Surge at hospitals
    - Disease outbreaks – local planners, epidemiologists
    - Large-scale communication efforts through HAN
      - Emergency communications to vulnerable populations
    - Training



**VDH** VIRGINIA  
DEPARTMENT  
OF HEALTH  
*Protecting You and Your Environment*

[www.vdh.virginia.gov](http://www.vdh.virginia.gov)

# Example: Wildlife

Expand Into Virginia



Have less habitat available in Virginia



Will be extirpated but survive elsewhere



Go extinct



# Example: Wildlife

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- Goals for managing wildlife with a changing climate:
  - Minimize the number of extinctions
  - Facilitate the gradual migration of species
  - Be efficient and cost effective
- Strategies:
  - Triage – focus efforts and resources on species that can be conserved.
  - Conserve and manage habitats, including corridors that provide connectivity
  - Use adaptive management process to design, implement, monitor, and adapt conservation actions



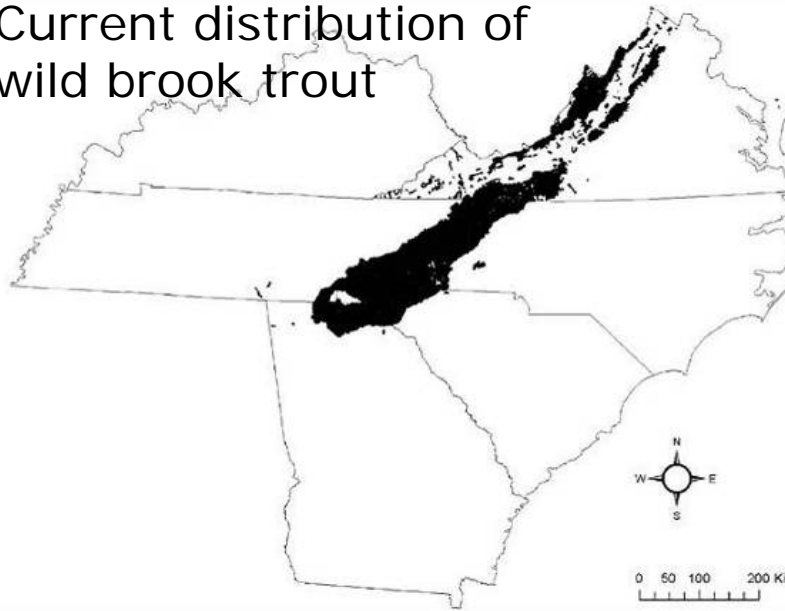
# Example: Wildlife

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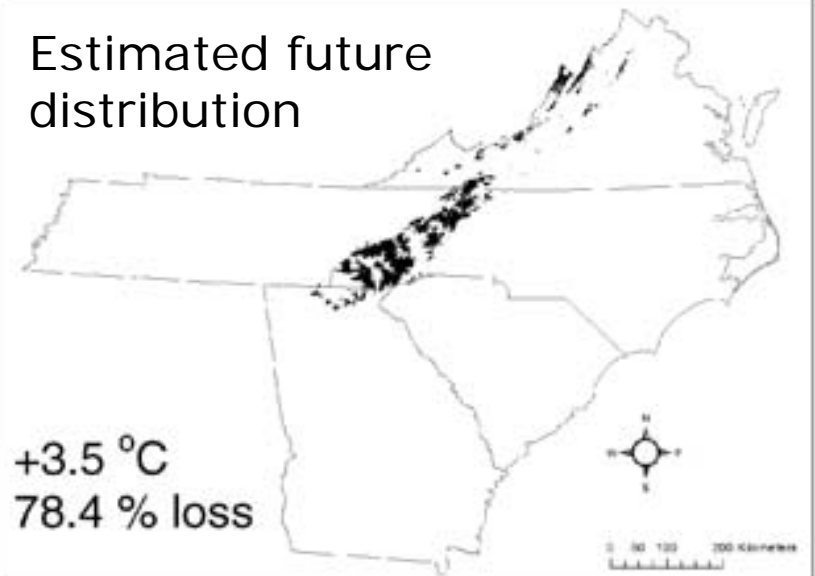
**VIRGINIA**



Current distribution of  
wild brook trout



Estimated future  
distribution



From: Flebbe et al. 2006

# Example: Land Use

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- Future development
  - Steer away from high-hazard zones
  - Consider climate change impacts in designating conservation areas
- Infrastructure planning



Figure 4

**Forward Commitment period by sector (years)**

Source: Andlug Consulting





# Example: Land Use

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- **Managed Retreat**
  - Land Planning – local and regional growth areas and natural resource/conservation areas
  - Relocation of existing buildings in hazard areas
  - Develop new building codes & envelopes
- **Protect**
  - Hard structures – dikes and levees
  - Soft protection – dune and wetland restoration/creation
- **Accommodate**
  - Monitor sea level rise, early warning, & evacuation.
  - Modification of existing land use
  - Strict land use regulation in hazard areas



# Example: Land Use

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## Alaska's experience

- Increased damage to coastal communities from storms and sea surges, made more vulnerable as a result of less and thinner sea ice, which used to provide natural protection from fall storms
- Failing support for buildings, roads, runways and other infrastructure due to melting permafrost
- Increased risks of fuel spills and other accidents from increased shipping and other activity in the Arctic and Aleutians resulting from less sea ice and better access



# Example: Land Use

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## Alaska's experience

- The costs of relocation or protection structures are very high
  - In the most at-risk villages of Kivalina, Newtok and Shishmaref, a technical analysis study in 2006 found each has 10-15 years before erosion impacts critical infrastructure,
  - The cost to move each village would range from \$80 million to \$200 million
- Other communities that are at risk from coastal erosion, flooding and wild land fires
- Federal emergency funding prioritizes areas of greater population and addressing the aftermath of disasters
- There is a lack of funds for planning, relocation and building structures to prevent disasters



# Example: Land Use

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Kivalina



Kivalina



Kivalina



# Impacts Expected in Virginia

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- **Presentation: “Impacts of Climate Change on Coastal Virginia and Chesapeake Bay”**
  - Higher coastal water levels and greater salinities
  - Shoreline erosion and submergence
  - Increasing nutrient inputs, decreases in oxygen content of estuarine waters, decreasing pH
  - Significant ramifications for coastal, bay and estuarine plants, animals, food webs and ecosystems
- **Presentation: “The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure”**
  - Norfolk Naval Facilities at risk for sea level rise
  - VA roads, rail, airports, and ports at risk
  - Transportation infrastructure and long-term planning for climate change risks necessary
- **Presentation: “National Security and the Threat of Climate Change”**
  - VA Beach: tourist destination that brings 11,400 jobs and \$895 million in revenue
  - VA Beach: commercial fishing industry worth more than \$130 million (2005)
  - 374 square miles of Virginia lie less than five feet above sea level



# VA CCC Adaptation Workgroup

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**State and local governments should adopt policy of adapting to:**

- Temperature increase of 3.6 degrees Fahrenheit
- Sea level rise of 2.3 feet, but tailored to local relative sea level rise
- Greater instability in weather patterns and precipitation



# VA CCC Adaptation Recommendations

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- High resolution topographic data (LIDAR) needed
- Ensure local governments have the statutory authority they need to address climate change
- State agencies, local governments and regional commissions and authorities include climate change in all planning efforts
- Revise zoning and permitting ordinances to address climate change impact
- Revise public health & emergency preparedness plans to account for climate change
- Assess economic impact and develop adaptation strategies



# VA CCC Adaptation Recommendations

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- Promote biofuels in a way that improves sustainability of agriculture
- Transportation and other infrastructure planning (state\$)
- Floodplain and shoreline management
- Public health: disease surveillance, new tracking mechanisms
- Emergency preparedness: storms, heat emergencies
- Study social and cultural impacts





# Natural Resources Adaptation - VA

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- Conserve priority species and natural habitats
- Enhanced water quality management –compensate for stress of temperature rise
- No net loss of natural carbon sinks –incentive-based program
- Natural sequestration carbon crediting system



# MD Adaptation Recommendations

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- **Take action now to protect human habitat and infrastructure from future risks.**
- ***Require*** the integration of coastal erosion, coastal storm, and sea-level rise adaptation and response planning strategies into existing state and local policies and programs.
- ***Develop*** and ***implement*** state and local adaptation policies (i.e., protect, retreat, abandon) for vulnerable public and private sector infrastructure.
- ***Strengthen*** building codes and construction techniques for new infrastructure and buildings in vulnerable coastal areas.



# MD Adaptation Recommendations

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- **Minimize risks and shift to sustainable economies and investments.**
- *Develop* and *implement* long-range plans to minimize the economic impacts of sea-level rise to natural resource-based industries.
- *Establish* an independent Blue Ribbon Advisory Committee to advise the state of the risks that climate change poses to the availability and affordability of insurance.
- *Develop* a *Maryland Sea-Level Rise Disclosure and Advisory Statement* to inform prospective coastal property purchasers of the potential impacts that climate change and sea-level rise may pose to a particular piece of property.
- *Recruit, foster, and promote* market opportunities related to climate change adaptation and response.



# MD Adaptation Recommendations

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- **Guarantee the safety and well-being of Maryland's citizens in times of foreseen and unforeseen risk .**
- ***Strengthen*** coordination and management across agencies responsible for human health and safety.
- ***Conduct*** health impact assessments to evaluate the public health consequences of climate change and projects and/or policies related to sea-level rise.
- ***Develop*** a coordinated plan to assure adequacy of vector-borne surveillance and control programs.



# MD Adaptation Recommendations

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- **Retain and expand forests, wetlands, and beaches to protect us from coastal flooding.**
- ***Identify*** high priority protection areas and strategically and cost-effectively direct protection and restoration actions.
- ***Develop*** and ***implement*** a package of appropriate regulations, financial incentives, and educational, outreach, and enforcement approaches to retain and expand forests and wetlands in areas suitable for long-term survival.
- ***Promote*** and ***support*** sustainable shoreline and buffer area management practices.



# MD Adaptation Recommendations

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- **Give state and local governments the right tools to anticipate and plan for sea-level rise and climate change.**
- ***Strengthen*** federal, state, local, and regional observation systems to improve the detection of biological, physical, and chemical responses to climate change and sea-level rise.
- ***Update*** and ***maintain*** state-wide sea-level rise mapping, modeling, and monitoring products.
- ***Utilize*** new and existing educational, outreach, training and capacity building programs to disseminate information and resources related to climate change and sea-level rise.



# MD Adaptation Recommendations

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- **State and local governments must commit resources and time to assure progress.**
- ***Develop*** state-wide sea-level rise planning guidance to advise adaptation and response planning at the local level.
- ***Develop*** and ***implement*** a system of performance measures to track Maryland's success at reducing its vulnerability to climate change and sea-level rise.
- ***Pursue*** the development of adaptation strategies to reduce climate change vulnerability among affected sectors, including agriculture, forestry, water resources, aquatic and terrestrial ecosystems, and human health.

